Next Generation Science Standards-Disciplinary Core Ideas with PLT Lessons
Forest Field Experiences

Kindergarten-Disciplinary Core Ideas	
NGSS-Disciplinary Core Idea	Outdoor Investigations/Explorations
LS1.C: Organization for Matter and Energy Flow in Organisms All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. (K-LS1-1)	Every Tree for Itself #27 Fallen Log #23
ESS2.D: Weather and Climate Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. (K-ESS2-1)	Weather investigations (www. pltwa.com web) Field, Forest, and Stream Variation PLT #48
ESS2.E: Biogeology Plants and animals can change their environment (K-ESS2-2)	Notice how dark and cool the forest is compared with open schoolyard Fallen Log #23
ESS3.A: Natural Resources Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K-ESS3-1)	Schoolyard Safari #46 Trees as Habitats #22 Fallen Log #23 Every Tree for Itself #27
ESS3.C: Human Impacts on Earth Systems Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. (K-ESS3-3)	Forest Benefits Habitat restoration
K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive. K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time. K-ESS2-2 Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. K-ESS3-1 Use a model to represent the relationship between the needs of different plants or animals (including humans) and the place they live. K-ESS3-3 Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.	

First Grade-Disciplinary Core Ideas	
NGSS-Disciplinary Core Idea	Outdoor Investigations/Explorations
LS1.A: Structure and Function • All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive and grow. (1-LS1-1)-Mimicry	• Adopt a Tree #21 • Tree Factory #63 • To be a Tree #62 • Tree Cookies #76 • Have Seeds Will Travel #43
LS1.B: Growth and Development of Organisms • Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. (1-LS1-2)	Tree Life Cycle #79
LS1.D: Information Processing • Animals have body parts that capture and convey different kinds of information needed for growth and survival. Animals respond to these inputs with behaviors that help them survive. Plants also respond to some external inputs. (1-LS1-1)	Signs of Fall #78 Have Seeds Will Travel #43
K-2 ETS1-2: Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	• Looking at Leaves #64 and Shape of Things #1-needle shapes allow plants to conserve water • Have Seeds Will Travel #43 design a seed
1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. 1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive. 1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents. K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	

Second Grade-Disciplinary Core Ideas	
NGSS-Disciplinary Core Idea	**Outdoor Investigations/Explorations**
LS2.A: Interdependent Relationships in Ecosystems • Plants depend on water and light to grow. (2-LS2-1) • Plants depend on animals for pollination or to move their seeds around. (2-LS2-2)	• Every Tree for Itself #27 • Have Seeds Will Travel #43 • Tree Cookies #76 • Sunlight and Shades of Green #42 • How Plants Grow #41 • Air Plants #28
LS4.D: Biodiversity and Humans • There are many different kinds of living things in any area, and they exist in different places on land and in water. (2-LS4-1)	• Planet Diversity #9 • Schoolyard Safari #46 • Trees (Forests) as Habitats #22 • Fallen Log #23 • Forest of ST Shrew #8
ESS2.C: The Roles of Water in Earth's Surface Processes • Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. (2-ESS2-3)	• Going outside to observe where water is and is it liquid or solid • Looking for examples of where wind and water have shaped the land and then mapping where changes have occurred • Water Wonders #44
K-2 ETS1-2: Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	• Looking at Leaves #64 and Shape of Things #1- needle shapes allow plants to conserve water. Conifer shape helps them shed snow

2-LS2-1.	Plan and conduct an investigation to determine if plants need sunlight and water to grow.
2-LS2-2.	Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
2-LS4-1.	Make observations of plants and animals to compare the diversity of life in different habitats.
2-ESS2-3.	Obtain information to identify where water is found on Earth and that it can be solid or liquid.
K-2-ETS1-1.	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2.	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Third Grade- Disciplinary Core Ideas	
NGSS-Disciplinary Core Idea	**Outdoor Investigations/Explorations**
LS1.B: Growth and Development of Organisms Reproduction is essential to the continued existence of every kind of organism. Plant and animals have unique and diverse life cycles. (3-LS1-1)	• Tree Life Cycle #79 • How Plants Grow #41
LS2.D Social Interactions and Group Behavior Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.	• Project WILD activities • Observing the behavior of flocks of birds in bushes or on water • Observing schools of fish
LS3.A: Inheritance of Traits • Many characteristics of organisms are inherited from their parents. (3-LS3-1) • Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2) LS3.B Variation of Traits • Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1) • The environment also affects the traits that an organism develops. (3-LS3-2)	• Looking at Leaves #64 • Signs of Fall #78 • Tree Cookies #76
LS2.C: Ecosystem Dynamics, Functioning, and Resilience • When the environment changes in ways that affect a place's physical characteristics, temperature or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment and some die. (3-LS4-4) LS4.C: Adaptation • For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. (3-LS4-3) LS4.D: Biodiversity and Humans • Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)	• Schoolyard Safari #46 • Trees as Habitats #22 • Planet Diversity #9 • Invasive species #12 • Birds and Worms #25 • Tree Cookies #76 Note: Increasing biodiversity or removing invasive organisms would be solutions to a problem

Third Grade- Disciplinary Core Ideas (continued)

NGSS-Disciplinary Core Idea	Outdoor Investigations/Explorations
Engineering Design-3rd through 5th grade	
ETS1.A: Defining and Delimiting Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criterial for success or how well each takes the constraints into account. (3-5-ETS1-1) **ETS1.B: Developing Possible Solutions** • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2) • At whatever stage, communicating with peers about proposed solutions is an important part of the design process and shared ideas can lead to improved designs. (3-5-ETS1-2) • Tests are often designed to identify failure points or difficulties, which suggest the elements of a design that need to be improved. (3-5-ETS1-3) **ETS1.C: Optimizing the Design Solution** Different solutions need to be tested in order to determine which of them best solves the problem given the criteria and the constraints. (3-5-ETS1-3)	Any engineering design project: • Stream/wetland restoration • Wildlife habitat improvements • Invasive plant removal • Stormwater runoff improvements (Drain Rangers curriculum Puget Sound Starts Here! website) • Butterfly/pollinator garden • Garden design Any testing of a solution: • Water quality testing • Butterfly counts • Bio blitz to count diversity of animals • Other animal counts such as frogs, salamanders etc.

3-LS1-1. Develop models to describe that organism have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

3-LS2-1. Construct an argument that some animals form groups that help members survive.

3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and the variation of these traits exists in a group of similar organisms.

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

3-LS4-4. Make a claim about the merit of a solution to a problem cause when the environment changes and the types of plant and animals that live there may change.

3-ESS2-1. Represent data in tables and graphical displays to describe typical weather condition expected during a particular season.

3-5-ETS1-1. Define a simple design problem reflecting need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Fourth Grade- Disciplinary Core Ideas	
NGSS-Disciplinary Core Idea	Outdoor Investigations/Explorations
LS1.A: Structure and Function Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior and reproduction. (4-LS1-1)	• Adopt a Tree #21 and • Looking at Leaves #64 • Tree Factory #63 • Tree Cookies #76
ESS2.A: Earth Materials and Systems Rainfall helps to shape the land and affects the types of livings things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils and sediments into smaller particles and move them around. (4-ESS2-1)	• Water Wonders #44, Part B • Soil Stories #70
ESS2.A: Biogeology Living things affect the physical characteristics of their regions.	• Field, Forest, Stream #48 • Water Wonders #44, Part B • Nothing Succeeds like Succession #80
ESS3.A: Natural Resources Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)	• Pollution Search #36 • Renewable or Not #14 • Energy Sleuths #39
Engineering Design-3rd through 5th grade	
ETS1.A: Defining and Delimiting Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criterial for success or how well each takes the constraints into account. (3-5-ETS1-1) **ETS1.B: Developing Possible Solutions** • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)	Any engineering design project: • Stream/wetland restoration • Bird/wildlife habitat improvements • Invasive plant removal • Stormwater runoff improvements (Drain Rangers curriculum Puget Sound Starts Here! website) • Butterfly/pollinator garden • Garden design Any testing of a solution • Water quality testing • Butterfly counts • Bio blitz to count diversity of animals

• At whatever stage, communicating with peers about proposed solutions is an important part of the design process and shared ideas can lead to improved designs. (3-5-ETS1-2) • Tests are often designed to identify failure points or difficulties, which suggest the elements of a design that need to be improved. (3-5-ETS1-3) ETS1.C: Optimizing the Design Solution Different solutions need to be tested in order to determine which of them best solves the problem given the criteria and the constraints.	• Other animal counts such as frogs, salamanders etc.

4-LS1-1. Construct an argument that plants, and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways

4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support and explanation for changes in a landscape over time.

4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.

3-5-ETS1-1. Define a simple design problem reflecting need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Fifth Grade- Disciplinary Core Ideas	
NGSS-Disciplinary Core Idea	**PLT Investigations/Explorations**
PS3.D: Energy in Chemical Processes and Everyday Life The energy released from food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1)	• Leaf as a system • Observe a habitat and draw the plants and animals in the habitat and then develop a food web model. A fallen log works well for this. (PLT #23)
LS1.C: Organization for Matter and Energy Flow in Organisms • Plants acquire their material for growth chiefly from air and water. (5-LS1-1) • Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion.	• Leaf/Tree/plant as a system • www.treebenefits.com for carbon sequestered • How Plants Grow #41 (not outdoors, but could be post) • Every Tree/Plant for Itself #27 • Sunlight and Shades of Green #42 • Air Plants #28 • Tree Cookies #76 • Tree Factory #63 • Students observe local ecosystems and model the transfer of energy in those systems.
LS2.A: Interdependent Relationships in Ecosystems • The food of almost any kind of animals can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat the plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or their parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1) LS2.B: Cycles of Matter and Energy Transfer in Ecosystems • Matter cycles between the air and soil and among plant, animals, and microbes as these organisms live and die. Organism obtain gases, and water from the environment and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)	• Fallen Log #23 • Trees as Habitats #22 • Natures Recyclers #24 • Web of Life #45 • Planet Diversity #9

Fifth Grade- Disciplinary Core Ideas (continued)	
NGSS-Disciplinary Core Idea	**PLT Investigations/Explorations**
ESS2.A: Earth and Materials and Systems Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather. (5-ESS2-1)	• Field, Forest, and Stream #48 • Soil Stories #70 Percolation through soils-water holding capacity of soils rich in organic material (interaction between bio and geo) • Bursting Buds #65 and submission to Budburst.org looking at temperatures influencing leaf and flower development.
ESS2.C: The Roles of Water in the Earth's Surface Processes Nearly all the Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands and the atmosphere. (5-ESS2-2)	Water Wonders (not outdoors, but kinesthetic water cycle - PLT #44)
ESS3.C: Human Impacts on Earth Systems Human activities in agriculture, industry, and everyday life have had major effects on land, vegetation, steams, oceans, air and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)	• Invasive Species #12 • Forest Management Strategies for Conservation • Forest for the Trees #69 • A Forest of Many Uses #32
Engineering Design-3rd through 5th grade	
ETS1.A: Defining and Delimiting Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criterial for success or how well each takes the constraints into account. (3-5-ETS1-1) **ETS1.B: Developing Possible Solutions** • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2) • At whatever stage, communicating with peers about proposed solutions is an important part of the design process and shared ideas can lead to improved designs. (3-5-ETS1-2) • Tests are often designed to identify failure points or difficulties, which suggest the elements of a design that need to be improved. (3-5-ETS1-3)	Any engineering design project: • Stream/wetland restoration • Wildlife habitat improvements • Invasive plant removal Any testing of a solution: • Water quality testing • Bio blitz to count diversity of animals • Other animal counts such as frogs, salamanders, etc.

ETS1.C: Optimizing the Design Solution Different solutions need to be tested in order to determine which of them best solves the problem given the criteria and the constraints.	
5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth was once energy from the sun. **5-LS1-1.** Support an argument that plants get the materials they need for growth chiefly from air and water. **5-LS2-1.** Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. **5-ESS2-1** Develop a model using an example to describe ways in which the geosphere, biosphere, hydrosphere, and/or atmosphere interact. **5-ESS3-1.** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. **3-5-ETS1-1**. Define a simple design problem reflecting need or a want that includes specified criteria for success and constraints on materials, time, or cost. **3-5-ETS1-2.** Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. **3-5-ETS1-3.** Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	

Middle School- Disciplinary Core Ideas	
NGSS-Disciplinary Core Idea	Outdoor Investigations/Explorations
LS1.B: Growth and Development of Organisms • Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4) • Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4) • Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)	• Observations of animals-birds and insects probably most accessible-but there are cameras on WA Fish and Wildlife website to observe. • Collecting and exploring seed dispersal (PLT Have Seeds Will Travel #43) • Comparing same species tree/shrub/ plant growth on N vs S slopes, in web vs dry areas, fertilized vs non-fertilized areas • Tree farm/orchards and tree/plant nurseries
LS1.C: Organization for Matter and Energy Flow in Organisms • Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)	• Leaf as a system with non-fiction read and Forest Fast Breaks
PS3.D: Energy in Chemical Processes and Everyday Life • The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e. from sunlight) to occur. In this reaction, carbon dioxide and carbon combine to form carbon-based organic molecules and release oxygen. (MSLS1-6) • Cellular respiration in plants and animals involves chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (MS-LS1-7)	• Leaf as a system with non-fiction read and Forest Fast Breaks (OFRI website) • Puget Sound or other water ways investigations-Water parameter investigations using which measure levels of oxygen in water during the day and at night clearly showing respiration of phytoplankton, algae and other plants • www.treebenefits.com shows carbon uptake by trees. • Temperature investigation and then looking at Global Climate Data (PLT #84)
LS2.A: Interdependent Relationships in Ecosystems • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for	**LS2 A to D standards** would lend themselves to any ecosystem from sagebrush to Puget Sound, Forests, Deserts, rivers, wetlands, etc.

limited resources, access to which consequently constrains their growth and reproduction. • Growth of organisms and population increases are limited by access to resources. • Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.	
LS2.B: Cycle of Matter and Energy Transfer in Ecosystems • Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.	
LS2.C: Ecosystem Dynamics, Functioning, and Resilience • Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. • Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.	• LS2 A-D standards would lend themselves to any ecosystem from sagebrush to Puget Sound, Forests, Deserts, rivers, wetlands, etc.
LS4.D: Biodiversity and Humans • Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. *(secondary)*	
ETS1.B: Developing Possible Solutions • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. *(secondary)*	
LS4.B: Natural Selection	

• Natural selection leads to the predominance of certain traits in a population, and the suppression of others.	
LS4.C: Adaptation Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes.	
ESS3.A: Natural Resources • Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.	
ESS3.C: Human Impacts on Earth Systems • Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. • Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	• Invasive species for other ecosystems • Visit Forests and measure and observe how they manage for wildlife
ESS3.D: Global Climate Change • Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.	Temperature studies along with CO2 levels. CO2 levels. There are many probes that student can access CO2 levels. PEI Performance Task *Climate Change, Carbon and Trees (PEI website)* along with measuring trees for the amount of Carbon they sequester and store. (PLT Global Climate, PLT Focus on Forest- Climate Change and Forests)
ETS1.A: Defining and Delimiting Engineering Problems • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. ETS1.B: Developing Possible Solutions	Engineering Design could occur in any ecosystem from stormwater runoff, to stream restoration, to wildlife/bird habitat restoration, to urban forest restoration.

- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.

ETS1.C: Optimizing the Design Solution

- Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design.

Middle School Performance Expectations

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-LS4-4. Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

MS-LS4-5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.